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**Rocky Mountain
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Fort Collins,
Colorado 80526

**General Technical
Report RM-138**

An Improved Framework for Estimating RPA Values

George L. Peterson, Thomas C. Brown, and Donald H. Rosenthal

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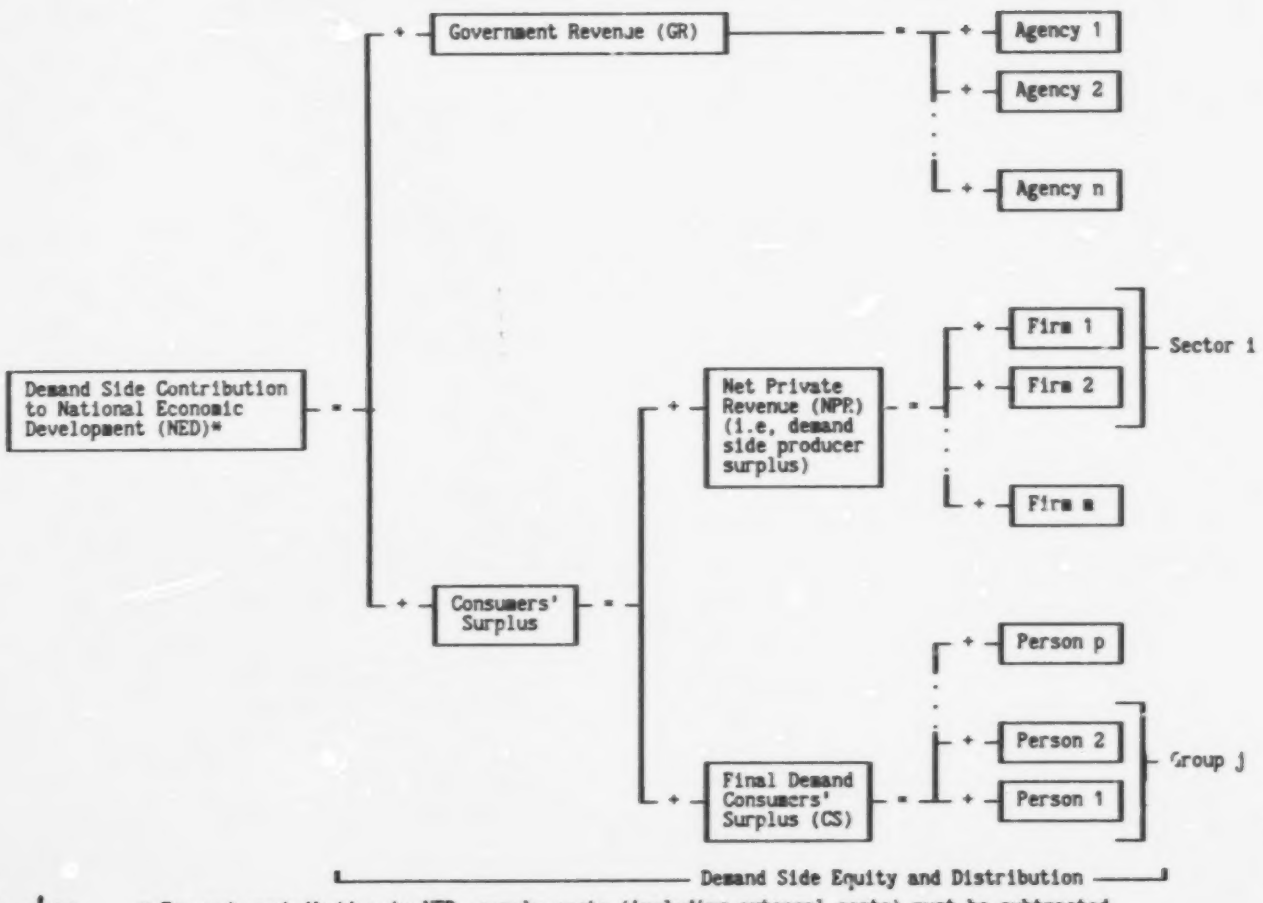

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I
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An Improved Framework for Estimating RPA Values

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Abstract

An RPA value is defined in terms of the philosophical basis for valuation, the objectives and accounts to be served, alternative planning models and pricing policies, the reference for change, and the assumed efficiency of past and future decisions. Guidelines for estimating and reporting RPA values are provided.

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II

An Improved Framework for Estimating RPA Values

George L. Peterson, Thomas C. Brown, and Donald H. Rosenthal

RPA Values and Properties

The Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974, as amended by the National Forest Management Act of 1976 (NFMA) was passed to make natural resource planning more rational and accountable. The RPA calls for planning at two levels, the national level and the forest level.

Two key documents produced at the national level are the Assessment and the Program. The Assessment describes the forest and rangeland situation at present, and analyzes the environmental, social, and economic trends that will likely affect the resource situation over the next 50 years. Opportunities and obstacles to make changes in the current and future resource situations are described for both public and private lands. Based on the findings of the Assessment, the Secretary of Agriculture recommends to the Congress a 50-year RPA Program for the Forest Service. The Recommended Program is a strategic plan that establishes long-term resource management goals. In the planning process, alternative national plans are developed that each reflect a different emphasis on the various resource management goals—a different strategy for meeting societal needs over the next 50 years. Each alternative includes elements for the three branches of the Forest Service—the National Forest System, Research, and State and Private Forestry. Each plan consists of many intermediate objectives that measure performance in attaining the goals.

In choosing which plan to recommend, the Secretary of Agriculture considers the environmental, social and economic consequences of each alternative. To analyze the economic consequences of each plan, it is helpful that the differing levels and timing of resource outputs are reduced to a common denominator and point in time. Dollars have been selected as the denominator and the present time as the point of comparison. Demand-side unit values must be estimated for each resource output or category of outputs to compute the value of benefits generated by each alternative plan. These unit values have been referred to as "RPA values." When supply costs are subtracted from the demand-side value of total resource outputs in any single year, the remainder is net value. Discounting net value to the present yields present net value (PNV). Present net value is used to rank alternatives in decreasing order of economic value. The PNV by resource output and the overall ranking are important decision criteria.

RPA values are also used in the forest planning process established under NFMA. Again, the values are used to analyze economic consequences of differences in resource output and to rank alternatives.

Several obstacles have prevented effective estimation and application of RPA values. Some resource outputs are exchanged in competitive markets and some are not. The forest management activities to be evaluated cause only marginal changes in output levels for some forest products and nonmarginal changes in others. Demand for some forest products is derived from demand for goods manufactured from the forest products, while other products are objects of final demand. If consistent, comparable values are to be developed for each resource output, these differences in products and the demands they create require analysts to use different methods to estimate values or to apply the methods in different ways. Proper application of methods and the values they produce requires clear understanding of complex concepts and clear separation of technical and policy issues. This report examines these problems and offers an improved framework for defining and estimating demand-side forest product values.

To be correct from the point of view of economic efficiency, an RPA value should be the demand-side per-unit monetary value for a specific change in the quantity of a forest product supplied at the on-forest point of production, i.e., the residual bid, or willingness to pay (WTP) per unit, to the Forest Service (or other land management agency) for the change. If the change in quantity does not cause a significant price change, it is marginal. Then, if the market is in efficient equilibrium, the current price is the appropriate RPA value, and the value of the entire marginal change is simply price multiplied by quantity. If the supply change causes a significant change in price, it is non-marginal. Then, the individual units comprising the change in output each will be valued differently. The value of the entire change is calculated by integrating the on-forest demand function over the range of the price change. An average unit price can be calculated for the change as a descriptive index and used as an RPA value. It applies only to that specific change and cannot be generalized to larger or smaller changes that yield a different average price.

Whether a change is marginal or non-marginal, its value may or may not be fully captured by the responsible land management agency. WTP for marginal change usually is fully capturable as revenue to the supplier under a uniform pricing policy. However, as with underpriced range permits, policy may dictate otherwise. When quantity is rationed by means other than price, the supplier is not likely to capture all the value.

WTP for nonmarginal change in output generally is not fully captured as revenue to the supplier under uniform pricing. When full WTP is not captured, there will be surplus to purchasers of the forest product. When the surplus is captured by firms that use the product as input in the production of income, the surplus is demand side producers' surplus (PS), income retained as real profit. When the surplus accrues to consumers who use the product in final demand, it is consumers' surplus (CS); that is, the surplus is income retained by the consumer as real purchasing power.

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The value of an on-forest product can vary by production location if there are differences in access to markets and, hence, differences in shipment costs, or if there are differences in local site attributes that cause production and extraction costs to vary from place-to-place. Therefore, it would not be reasonable to expect a single RPA value to be valid region-wide for a given forest product. However, it may be possible to estimate region-wide prices or demand models for derived products such that location-specific RPA values for the on-forest product can be derived with little expense or complication. For example, a site specific stumpage value could be derived from a regional lumber demand model.

The Philosophical Basis for Valuation

Figure 1 shows that value can be defined by individual preferences (consumer sovereignty), by government authority as in a command economy, or by other criteria. Consumer sovereignty is the basis for competitive markets and neoclassical microeconomic theory. It is also the constitutional platform from which government is derived by social contract in the United States.

Given consumer sovereignty as the justification for value, it is then necessary to agree on a basis for assigning and measuring value. One approach is to accept the "exchange value" concept of neoclassical economic theory. Under this approach, a thing is worth the amount of money for which it can or could be exchanged, which is determined in a competitive market by equilibration of willingness to pay (WTP) and compensation demanded (CD). It is reasonable and consistent to adopt this competitive market model for assigning RPA values.

However, actual values are reflected by the sovereign preferences of people as expressed through due process. Values derived solely from economic theory may not reflect political reality. Other bases for assigning value are conceivable, such as voting behavior or various nonmonetary valuation methods. It is also important to recognize that monetary exchange values depend on the existing distribution of income. The results might be different under some other income distribution.

Given the economic definition of value in exchange as derived from individual preferences and competitive market transactions, it is necessary to identify ways to measure WTP and CD. There are two basic approaches: (1) observation of demand in real markets, and (2) observation of demand in hypothetical markets. Observation of demand for private goods traded in real markets yields prices (i.e., demand at the point of intersection with supply) that can be used to value marginal changes. However, it is necessary to evaluate all observed prices for distortion. Where market imperfections exist, observed prices may not be valid.

When quantity changes are not marginal, it may be necessary to estimate a portion of the demand function from observation of market transactions in order to

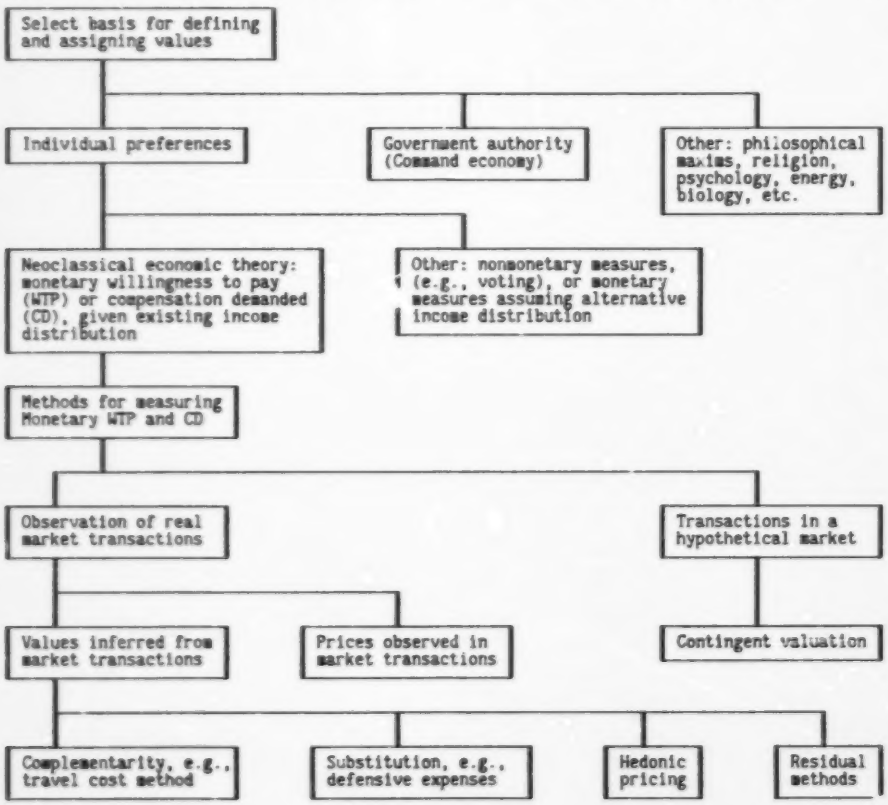
Select basis for defining and assigning values
Individual preferences
Government authority (Command economy)
Other: philosophical maxims, religion, psychology, energy, biology, etc.
Neoclassical economic theory: monetary willingness to pay (WTP) or compensation demanded (CD), given existing income distribution
Other: nonmonetary measures, (e.g., voting), or monetary measures assuming alternative income distribution
Methods for measuring Monetary WTP and CD
Observation of real market transactions
Transactions in a hypothetical market
Values inferred from market transactions
Prices observed in market transactions
Contingent valuation
Complementarity, e.g., travel cost method
Substitution, e.g., defensive expenses
Hedonic pricing
Residual methods

Figure 1.—How is value defined and measured.

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assign value to the changes. Goods not traded in real markets sometimes can be priced by derivation from the prices of market goods through complementary or substitute relationships. Travel cost analysis and hedonic pricing are examples.

The hypothetical market methods are generally termed "contingent valuation methods" (CVM). Demand (i.e., marginal willingness to pay as a function of quantity purchased) is estimated by observing the choices and exchanges people make in hypothetical (i.e., experimental) market situations.

Market imperfection generally involves "non-market" goods that are somewhat non-excludable or non-rival in consumption. Production of such goods usually is not profitable to private enterprise, even though failure to produce may be inefficient from a societal viewpoint. If economic efficiency is of concern, the value of public as well as private goods must be estimated.

Objectives and Accounts Served

"Value" also depends on the objectives to be served by the evaluation in which an RPA value is used. Economists often assume the objective is economic efficiency. This follows from their acceptance of consumer sovereignty and market mechanisms for allocating resources. Economic efficiency can be applied over any desired geographical or political boundary. For Federal agencies, whose boundary is the whole country, the RPA value should measure the demand-side contribution to the national economic development (NED) account (i.e., gross returns to aggregate national economic efficiency). Subtracting the supply costs of an alternative from its demand-side contribution to NED gives the net contribution to NED. The implied question is whether the nation in aggregate is economically better off with or without the proposed change.

However, as shown in figure 2, there may also be other objectives. If an objective is a balanced federal budget, it is important to examine the government net revenue account. Here, value measures the contribution to government revenue (GR), from which government costs are subtracted to estimate contribution to a balanced budget. Other objectives might be concerned about consumers' surplus (CS) or net private revenue (NPR), redistributing income, minimizing government expenditure, and achieving certain levels of output.

A value defined in terms of the NED account can be disaggregated to the GR, CS, and NPR subaccounts. The NED value gives the maximum willingness to pay (or compensation demanded) for the specified change in an on-forest product. If the change is marginal and the product is sold at its competitive market price, the entire NED value of the change is captured by the government agency as GR. Under other circumstances, the consumers of the on-forest product retain some or all of their willingness to pay as consumers' surplus. If the consumers are firms using the on-forest product as an input, the consumers' surplus translates into real profit (NPR) in the

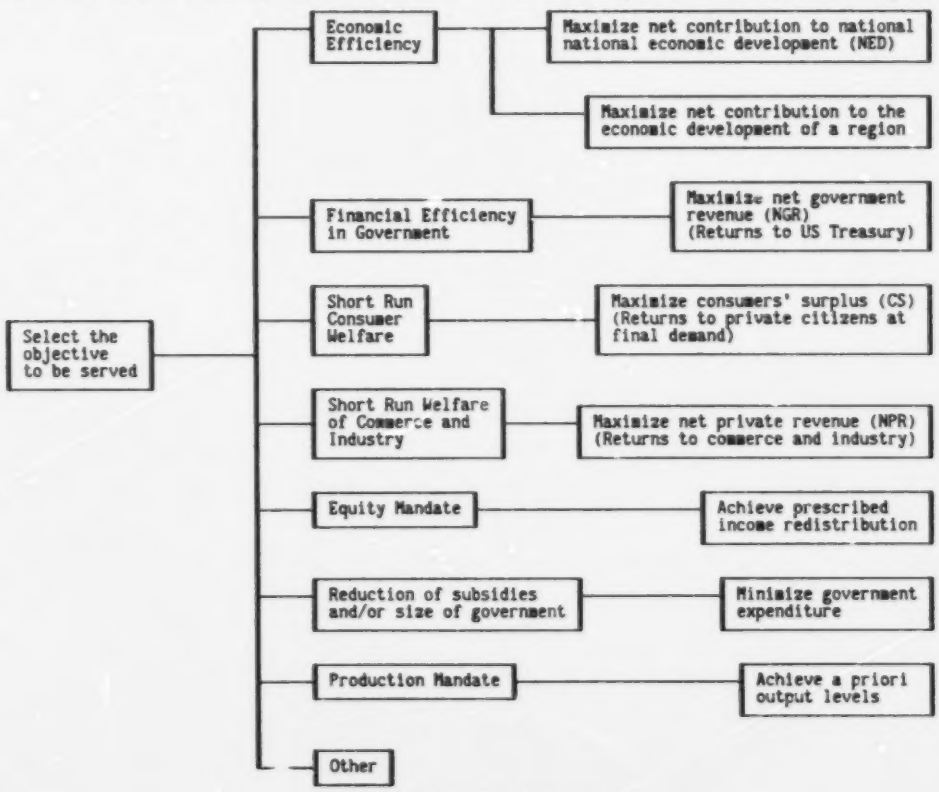
Select the objective to be served
Economic Efficiency
Maximize net contribution to national national economic development (NED)
Maximize net contribution to the economic development of a region
Financial Efficiency in Government
Maximize net government revenue (NGR) (Returns to US Treasury)
Short Run Consumer Welfare
Maximize consumers' surplus (CS) (Returns to private citizens at final demand)
Short Run Welfare of Commerce and Industry
Maximize net private revenue (NPR) (Returns to commerce and industry)
Equity Mandate
Achieve prescribed income redistribution
Reduction of subsidies and/or size of government
Minimize government expenditure
Production Mandate
Achieve a priori output levels
Other

Figure 2.—Possible objectives.

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firms' production processes. If the consumers are forest users purchasing for final demand, the surplus remains consumers' surplus (CS). For some changes, two or all three of these accounts receive some value.

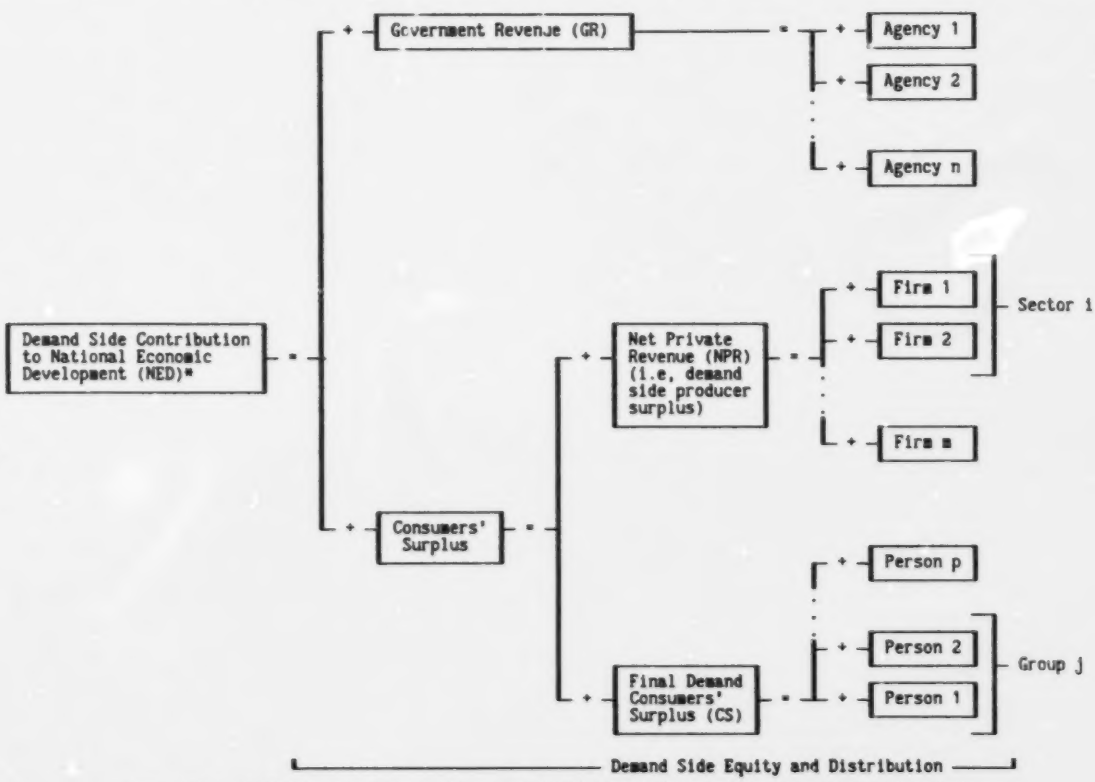
As shown in figure 3, when defined properly, contributions to these three subaccounts sum to the contribution to the NED account. Such disaggregation exposes the distribution of NED gains (or losses) in the three sectors of the economy representing the interests of the U. S. treasury, private citizens, and private industry, and is one way of examining the "equity" of an alternative. Equity is concerned with the distribution of gains and losses among individuals and groups and belongs in the domain of political conflict resolution. Although only three subaccounts have been identified here, many are conceivable (e.g., representing the interests of individuals, geographic regions, ethnic groups, organizations, etc.)

Exposing the impacts of a change in the output quantity of a forest product on various subaccounts is important, because two actions equally efficient and productive from the NED perspective may cause different distribution of impact among the GR, CS, and NPR subaccounts. It is important to examine tradeoffs among these and other subaccounts, because these tradeoffs relate to objectives other than economic efficiency at the aggregate national level. However, to use one of the subaccounts as the sole criterion from which to allocate public resources and thus to estimate RPA values may have bizarre consequences. For example, only looking at the GR account (focusing only on the objective to maximize net government revenue) might lead government to behave as a profit maximizing monopolist. It might also lead to failure to produce valuable non-market goods, such as national defense, education, public utilities, and wilderness. Such outcomes conflict with the economic efficiency objective and the perspective of public trust.

Alternative Planning Models

The strategy used in RPA planning is one of trial and error, in which several alternatives are first designed, then evaluated and ranked. To put this approach in proper perspective and to better clarify the purpose of an RPA value, it is useful to look at alternative planning models. Figure 4 presents three basic approaches to resource allocation, which can be further classified either as theoretical or realistic.

The three approaches are: (1) market equilibrium, (2) simulated market equilibrium, and (3) trial and error planning. A market allocates resources and assigns prices by equilibrium between supply and demand (i.e., equation of WTP and CD). In theory, equilibrium in a perfectly competitive market is economically efficient. That is, it would be impossible to make an improvement in the NED account. The resulting resource allocation and prices are



* For net contribution to NED, supply costs (including external costs) must be subtracted.

Figure 3.—Components of the demand side contribution of a government action to national economic development.

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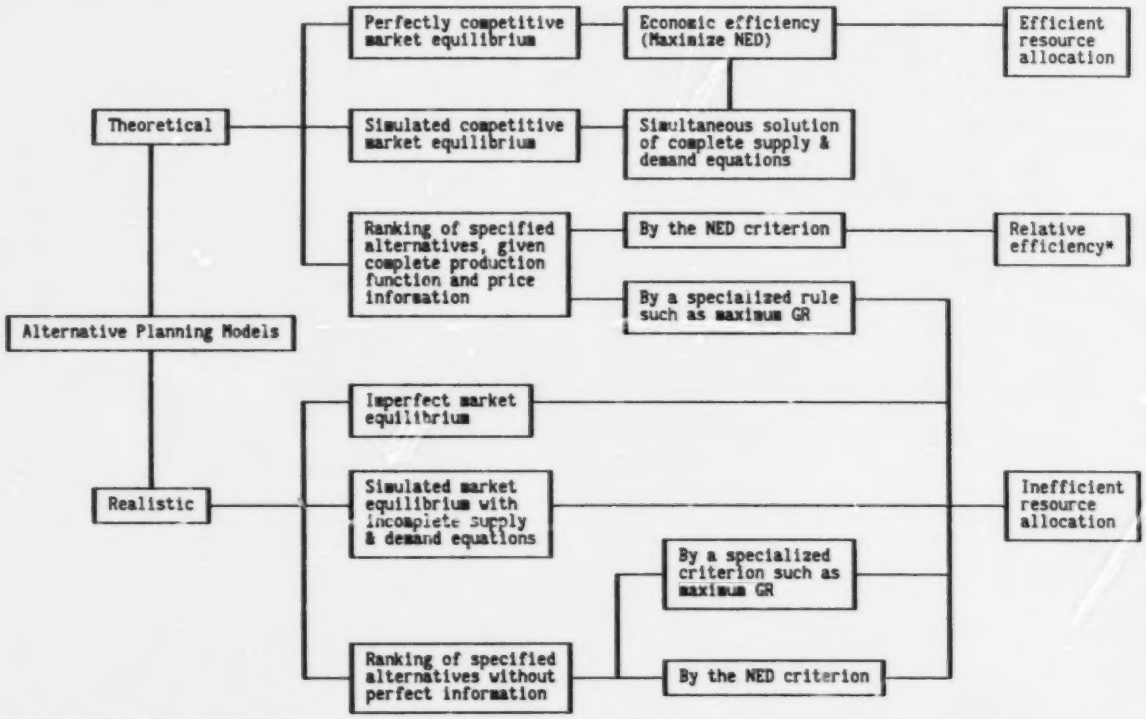
Alternative Planning Models
Theoretical
Realistic
Perfectly competitive market equilibrium
Economic efficiency (Maximize NED)
Efficient resource allocation
Simulated competitive market equilibrium
Simultaneous solution of complete supply & demand equations
Ranking of specified alternatives, given complete production function and price information
By the NED criterion
Relative efficiency*
By a specialized rule such as maximum GR
Imperfect market equilibrium
Simulated market equilibrium with incomplete supply & demand equations
Inefficient resource allocation
By a specialized criterion such as maximum GR
Ranking of specified alternatives without perfect information
By the NED criterion

* When alternatives from an incomplete set are ranked by the NED criterion with perfect information, the result is that they are ranked by efficiency, relative to each other. However, the efficient alternative cannot be selected if it is not included in the set. Trial and error modification and ranking of alternatives with perfect information might, but will not necessarily, converge to efficiency.

Figure 4.—Alternative planning models.

the best possible considering the economic efficiency objective and given the initial distribution of income.

However, real markets are imperfect. Monopoly, external diseconomies, and public goods tend to cause equilibrium in real markets to fall short of economic efficiency. Such imperfections are generally regarded as justification for government actions such as RPA planning.

From the economic efficiency point of view, the ideal way to correct market imperfections would be to simulate perfect market equilibrium. In theory, marginal cost (supply) and marginal WTP (demand) equations could be specified for every conceivable product, whether or not such products have the characteristics of private goods. Such equations would include external (social) costs and benefits and joint production and consumption relationships. Simultaneous solution (intersection) of all these supply and demand equations would specify efficient prices and the efficient allocation of resources.

In practice, such an approach is generally not realistic. Complete specification and estimation of all the required equations is not possible at acceptable cost. Simple approximations of some equations might be reasonable; but use of incompletely specified equations for this kind of simulated equilibrium analysis is certain to lead to inefficient allocation of resources.

The third planning approach shown in figure 4 is trial and error. In this approach, designers create a limited set of feasible actions. Presumably, they are guided by criteria that help them create good alternatives. The costs and benefits are estimated and summed for each, for example, as net present worth. When the NED criterion is used, the method is called "benefit-cost analysis" (BCA). Given perfect information about the production functions and prices, BCA ranks the alternatives according to relative economic efficiency. That is, they are ranked in order of their net contribution to NED. If some criterion other than NED (such as GR, NPR, or CS) is used, the alternatives will not necessarily be ranked by relative economic efficiency.

If the NED criterion is used and the set of alternatives evaluated includes the globally efficient one that, in concept, would be the outcome of simulated market equilibrium, it will be ranked first by BCA. However, it is not likely, at least on first try, that the designers will be able to produce this ideal alternative. If they knew how to do that, the trial and error method would not be needed. In theory, iterative redesign and evaluation might converge toward optimal resource allocation; but trial and error planning usually stops short of economic efficiency, even with complete information about production functions and prices.

In practice, such information is also likely to be imperfect. Some of the products will be public goods, and their quantities and prices will have to be estimated by imperfect methods. Therefore, trial and error planning can be expected to produce results that are less than efficient, even when the NED criterion is used. However,

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it is important to note that when the NED criterion is used, RPA planning aims at the perfect market outcome. Success in achieving that outcome is limited only by information and creativity, not by the direction of aim. When some other criterion (such as GR, NPR, or CS) is used to define the RPA values, the implied aim of the planning process is toward something other than the ideal market (efficient) allocation of resources. Deciding what the aim ought to be is a political responsibility, not a technical responsibility. However, it is important to understand the target.

Alternative Pricing Policies

The prices assumed to be in effect for government supplied forest products will influence returns calculated in the NED, GR, CS, and NPR accounts. Figure 5 shows that pricing policy must be specified as well as the valuation account before estimating RPA values. Use of different assumed pricing policies in ranking RPA alternatives allows pricing policy to be ranked. For example, if the NED account is used, returns to that account from each alternative under each pricing policy might be estimated. The outcome would show which pricing policy gives the greatest return while also ranking the RPA alternatives.

Several hypothetical pricing policies might be considered. From the point of view of neoclassical economic theory, the marginal cost price yields the greatest return to the NED account. This is the price at which marginal cost (MC) and marginal WTP (MWTP) are equal, the condition of equilibrium in the ideal market. However, the MC and MWTP depend on the decision in question. Any cost or benefit that varies with versus without the change is marginal to that decision. A given planning alternative may include both long- and short-run considerations.

Private firms generally strive to maximize profit, which requires MC and marginal revenue (MR) to be equal. Under perfect competition the two rules (MC = MR and MC = MWTP) give the same efficient allocation of resources. When public goods, external diseconomies, or monopolistic conditions are involved, the MC = MR rule gives inefficient results. Use of the GR account by government as the sole criterion for resource allocation is equivalent to the MC = MR rule. Possible consequences include monopolistic behavior, failure to provide public goods and services, and failure to correct external income transfers in the economy.

It is necessary to decide which pricing policy to use as a basis for estimating RPA values. The appropriate pricing policy to use is the one expected to be in place during the planning period of the RPA analysis, unless one of the purposes is to evaluate alternative pricing schemes. Given a decision about pricing policy and accounting stance, figure 5 shows how to proceed with the estimation of RPA values and sub components.

The Reference for Change

Economic value as derived from the rational framework of economic theory and ideal market behavior has meaning only in terms of "with vs. without" the thing to which value is to be assigned. If alternative policy actions are to be ranked, RPA values and the rankings may be different for different null (i.e., "without") alternatives. It is essential to specify the null alternative to which policy alternatives are to be compared before RPA value can be assigned.

The logical null alternative is a continuation of current management direction. It is a practical choice for two reasons. First, the RPA planning exercise is largely an evaluation of whether the current management direction should be changed. Second, existing market prices indicate (except where distortions exist) the value of marginal change from the existing situation, but may not correctly measure the value of marginal change from some other base.

Figure 6 shows five general options for specifying change, where four and five are the practical options.

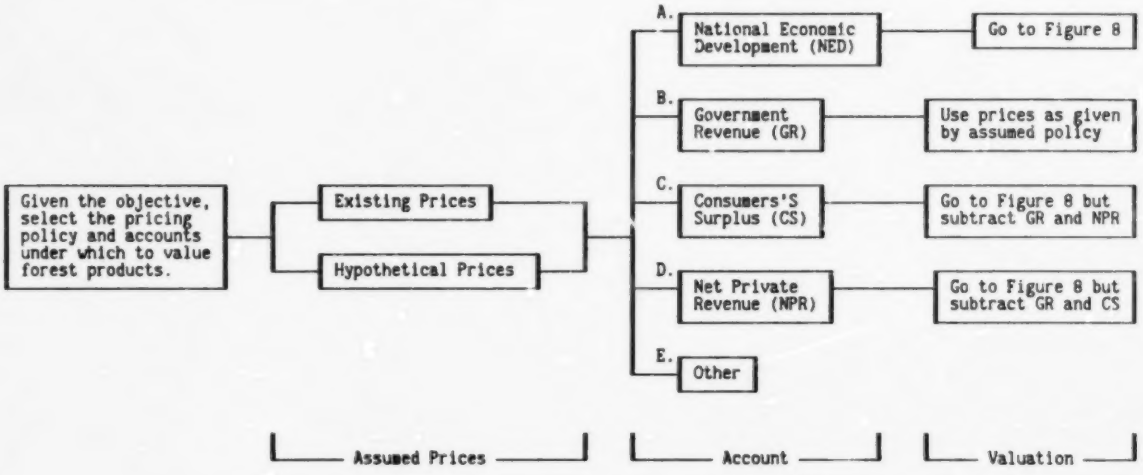

Figure 5.—Alternative pricing policies and accounting stances from which to assign RPA values.

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RPA value might be assigned based on the following types of changes from the current situation:

1. no production at all (i.e., zero output),
2. no management at all,
3. custodial management only,
4. realistic alternatives, and
5. one more or one fewer unit.

Values of some on-forest products will differ, depending on which of these types of change is being evaluated. Furthermore, the accuracy with which values can be estimated generally increases from option 1 to option 5 (i.e., as the quantity of change becomes smaller).

The investment unit provides the reference for valuation of a given decision regarding a proposed investment. The investment unit is defined by the level at which the investment decision is being made. With "lumpy" decisions, the investment unit might be a timber sale or recreation site. At a more disaggregate level, the investment unit might be a cord of wood or unit of recreation capacity at an existing site. The RPA value will depend on the unit of investment to which it is to be assigned. For example, the value of a new recreation site divided by the number of its units of recreation capacity is not necessarily the same as the value of one more unit of capacity at the site. This problem is simply another way to state the marginal vs. non-marginal question.

In general, the RPA value should be estimated for the actual changes proposed (i.e, the RPA alternatives that need to be ranked). Such alternatives are generally limited to categories four and five above. The first three are not likely to appear.

Assumptions about the Efficiency of Past and Future Decisions

If past knowledge or control of the future were perfect and if resources were allocated based on neoclassical economic theory, current allocation decisions would be trivial. However, past knowledge and control of the future have been imperfect; therefore, opportunities exist for new investment that are of greater value than some existing operations. Thus, investment and disinvestment decisions may require different RPA values (fig. 7).

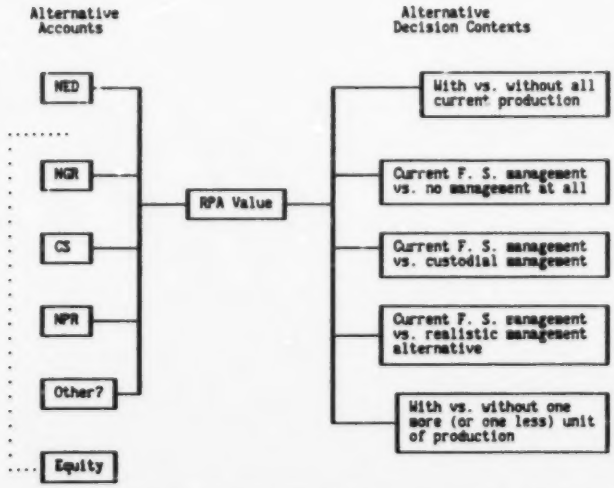

Figure 6.—Interaction of accounting stance with the decision context.

The imperfection of knowledge and control of the future has important implications for the estimation of the RPA values to be used in ranking alternatives, particularly if the alternatives are expressed in terms of allocation of money among Forest Service regions or other management units. If it is not certain how resources thus allocated will be invested, it is not possible to assign an accurate RPA value, because value is conditional on the actual changes proposed. Instead, it is necessary to estimate the most likely value of return on investment in a given management area, given limited knowledge of what that area's investment alternatives are, and how resources will be allocated among them.

To evaluate and rank all the investment and disinvestment opportunities facing a management area is generally too expensive to be practical. A more reasonable approach is to evaluate a sample of opportunities and then estimate a distribution of value from that sample. For example, assume the management decision is to open new recreation sites or to close existing ones. Value with vs. without each site in a sample of candidate sites could be estimated.

If the investment unit is the recreation site, the proper way to calculate the value of each site is with vs. without that site, assuming all others remain unchanged, i.e., valuation of each site at the margin. If future investments will be random or uniform, the expected value (average) is the best value to use. If the management area will tend to make efficient decisions, the appropriate RPA investment value should be above the average, and the appropriate disinvestment value should be below the average. Exactly how far above or below the estimated average site value these values should be is a judgment call. If high efficiency is expected, the values should be out in the tails of the distribution. If little improvement over randomness is expected, the values should be near the average. It is a matter of the expected productivity of investment decisions in the management area.

Estimation of RPA Values

The recommended procedures for estimating RPA values are highly technical. Many important considerations have been outlined here, but only in the most general terms. It is important not to expect or impose invalid simplifications. Estimation of RPA values requires a combination of (1) explicit performance specifications, and (2) expert command of complex concepts and methods. It is essential to keep policy judgments and technical reasoning separate.

Figures 5 and 8 give a graphic summary of technical guidelines for RPA valuation. These guidelines are outlined in the following sections for various accounts and objectives for which RPA values might be assigned.

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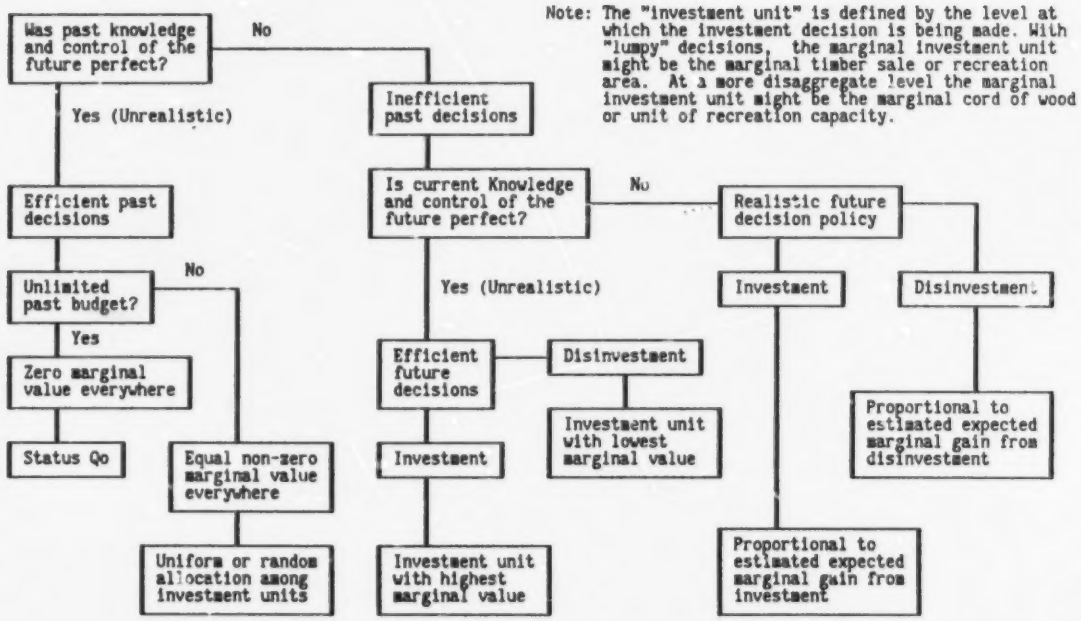
Was past knowledge and control of the future perfect?
No
Yes (Unrealistic)
Inefficient past decisions
Efficient past decisions
Is current Knowledge and control of the future perfect?
No
Realistic future decision policy
Unlimited past budget?
No
Yes (Unrealistic)
Investment
Disinvestment
Yes
Zero marginal value everywhere
Efficient future decisions
Disinvestment
Proportional to estimated expected marginal gain from disinvestment
Status Qo
Equal non-zero marginal value everywhere
Investment
Investment unit with lowest marginal value
Uniform or random allocation among investment units
Investment unit with highest marginal value
Proportional to estimated expected marginal gain from investment
Note: The "investment unit" is defined by the level at which the investment decision is being made. With "lumpy" decisions, the marginal investment unit might be the marginal timber sale or recreation area. At a more disaggregate level the marginal investment unit might be the marginal cord of wood or unit of recreation capacity.

Figure 7.—Investment criteria under perfect and imperfect information scenarios.

NED Guidelines and Conclusions

The following statements are based on the conclusion that RPA values are to be defined relative to the National Economic Development account to measure achievement of the economic efficiency objective. Other accounting perspectives, as derived from other objectives such as Government Revenue, Consumers' Surplus, or Net Revenue to Private Firms, are discussed in subsequent sections. Because an RPA value includes only demand-side WTP, these conclusions are not concerned with estimation of supply-side surplus. The conclusions are summarized graphically in figure 8.

1. The question(s) to be answered must be explicitly stated, because economic value has meaning only in terms of change and comparison. In general, the "with vs. without" comparison must be specified before value can be assigned.

2. Forest products and their respective units of supply and demand should be defined by forest product specialists who understand the processes of production and consumption, the application intended for the values, and the valuation process. A major source of confusion in the definition, estimation, and application of RPA values is inadequate or improper definition of units of forest product supply and demand. Units need to be defined in market and policy-consistent terms.

3. Published RPA values should be accompanied by an explanation of how they were derived and a statement of the specific questions to which they are and are not applicable. When values are not accompanied by such information, there is potential for misapplication.

4. Published RPA value information should be accompanied by procedures for estimating forest product values in terms of specific decisions and conditions to which the published "generic" values are not applicable.

5. The demand-side value of a Forest Service action should be defined as net WTP for the change in the supply of on-forest products. "Net" means the residual WTP remaining after payment of all real costs of acquiring the on-forest product other than payments to the Forest Service. "Real costs" refer to the cost of removing or using the forest product, assuming the input factors are purchased at the margin and are priced efficiently.

6. Marginal and nonmarginal change must be carefully distinguished. A marginal change does not significantly change price. A nonmarginal change does. For nonmarginal changes, valuation cannot be achieved in terms of a simple "price times quantity" calculation, unless the "price" is a valid average for the exact change to which value is to be assigned.

7. For a marginal change in the quantity supplied of an on-forest product, the correct demand-side value is the price defined by competitive equilibrium between on-forest supply and demand. That equilibrium occurs at equality between marginal WTP (demand) and marginal cost (supply).

8. The net WTP for marginal changes in the quantity of forest products supplied may not be fully captured by the prices which transfer payment from consumers to suppliers if those prices are distorted (e.g., when consumption is rationed by means other than price and there is excess demand at the existing price).

9. If parallel private competitive markets exist for nonpriced on-forest products, the private market prices may be appropriate for valuation of marginal changes in units supplied by the Forest Service. However, because of the possibility of complementarity and substitution between

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publicly and privately supplied units of the good, the private market prices should be scrutinized for distortion. Also, adjustment must be made for differences in market structure. For example, with recreation, differences in the relative location of consumers vis-a-vis recreation sites are common, causing price differences that are not easily taken into account. Because of this, private market prices for recreation may have little validity for valuing recreation on public lands. Research is needed to evaluate the effects of substitution relationships, quality differences, population distributions, and site location before comparisons of public and private recreation prices will be meaningful.

10. Where an on-forest product that is not competitively priced can be traced via derived demand to an off-forest private good traded in a perfectly competitive market, the on-forest market equivalent price of a marginal change may be derivable via residual techniques from the price of the off-forest commodity. For example, the marginal value product of an animal unit month of range forage can be estimated from the competitive market for red meat if the competitive prices of other input factors in the production function are known. Before off-forest prices for private goods are used to derive on-forest residual prices, the off-forest prices should be examined for distortion. Where market imperfections are present, the off-forest prices may be incorrect.

11. The off-forest price or demand function should be specified and estimated at the point where the chain of products derived from the on-forest product enters an uninterrupted chain of perfectly competitive markets, or at final demand, whichever comes first. At this point the prices and demand functions will have maximum generalizability, and will be most likely to achieve region-wide applicability. The "perfect market" concept should be applied as a reasonable approximation, meaning that the product and all products derived therefrom are traded at about short-run marginal cost by competitive equilibrium with no consumers' surplus at the margin.

12. Where prices of non-priced on-forest commodities are not obtainable from off-forest or parallel competitive markets, it may be possible to estimate market equivalent prices from estimated on-forest supply and demand curves. The market equivalent price is determined by equality of marginal WTP (demand) and marginal cost (supply).

13. If the on-forest product is a public good, meaning it is non-rival in consumption, the aggregate demand function is defined differently than for a private good. Because a unit of the good can be used simultaneously by several people, aggregate marginal WTP is the sum of the WTP of the several people. It is the vertical sum of the individual demand curves, given quantity, rather than the horizontal sum, given marginal WTP. The marginal

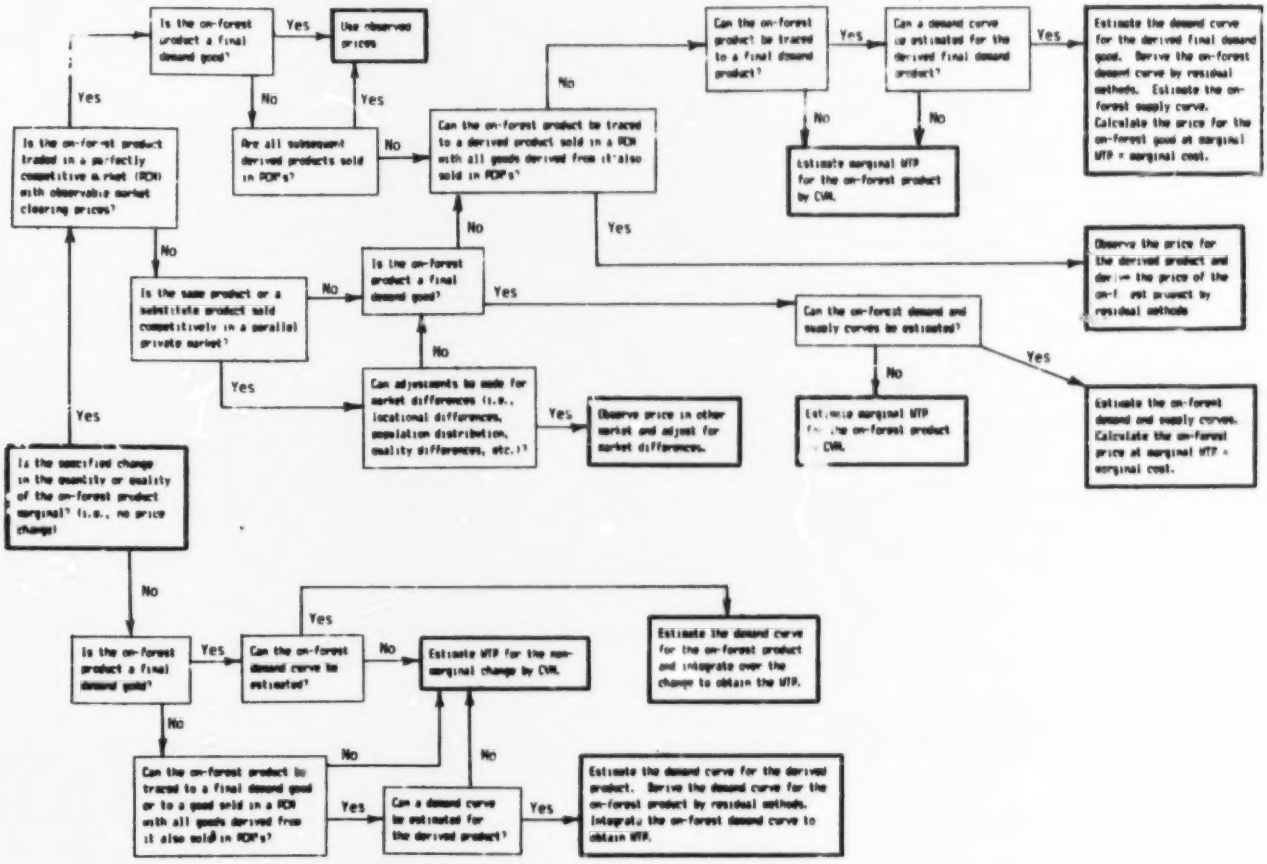
Is the on-forest product a final demand good?
Yes
Use observed prices
No
Are all subsequent derived products sold in POP's?
Yes
No
Is the on-forest product traded in a perfectly competitive market (POM) with observable market clearing prices?
Yes
No
Can the on-forest product be traced to a derived product sold in a POM with all goods derived from it also sold in POP's?
No
Yes
Can the on-forest product be traced to a final demand product?
Yes
No
Can a demand curve be estimated for the derived final demand product?
Yes
No
Estimate the demand curve for the derived final demand good. Derive the on-forest demand curve by residual methods. Estimate the on-forest supply curve. Calculate the price for the on-forest good at marginal WTP = marginal cost.
Estimate marginal WTP for the on-forest product by CVM.
Observe the price for the derived product and derive the price of the on-forest product by residual methods
Is the same product or a substitute product sold competitively in a parallel private market?
No
Yes
Is the on-forest product a final demand good?
No
Yes
Can the on-forest demand and supply curves be estimated?
Yes
No
Can adjustments be made for market differences (i.e., locational differences, population distribution, quality differences, etc.)?
Yes
Observe price in other market and adjust for market differences.
Estimate marginal WTP for the on-forest product by CVM.
Estimate the on-forest demand and supply curves. Calculate the on-forest price at marginal WTP = marginal cost.
Is the specified change in the quantity or quality of the on-forest product marginal? (i.e., no price change)
Yes
No
Is the on-forest product a final demand good?
Yes
No
Can the on-forest demand curve be estimated?
Yes
No
Estimate WTP for the non-marginal change by CVM.
Estimate the demand curve for the on-forest product and integrate over the change to obtain the WTP.
Can the on-forest product be traced to a final demand good or to a good sold in a POM with all goods derived from it also sold in POP's?
Yes
No
Can a demand curve be estimated for the derived product?
Yes
No
Estimate the demand curve for the derived product. Derive the demand curve for the on-forest product by residual methods. Integrate the on-forest demand curve to obtain WTP.

Figure 8.—A decision path for estimation of on-forest product value.

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value of an additional unit of capacity, therefore, is the sum of the WTP of all people who will use that unit.

14. When a change in the supply of an on-forest product would cause a significant change in the price of that product, nonmarginal valuation methods should be used. The demand-side value of the supply change is, again, net WTP at the forest for the change. This net WTP includes, by definition, consumers' surplus. Such WTP should be calculated by integration of the on-forest demand function over the range of the change.

15. The value per unit of output change in an on-forest product, whether determined for a marginal or nonmarginal change, can be expected to vary among production sites within a region. It should not be assumed that such variation is negligible. Variation among production sites needs to be described to allow decision makers to decide whether the variation is sufficient to cause unacceptable errors.

16. Where available, region-wide off-forest demand curves are useful for valuation of management actions that affect the supply of related on-forest products. Whether it is possible to estimate such curves (or portions thereof) for the region as a whole depends on the nature of the market in the region. If the market is not uniform region-wide, two other possibilities remain. One is to estimate subregional off-forest demand functions that correspond to subregional market areas. The other is to estimate a generalized regional demand model capable of describing price-quantity relationships anywhere in the region. Such a generalized demand model should be specified in terms of substitute prices, supply variables, and demographic demand shifters.

17. For forest products that tend to have only marginal supply changes that can be traced to parallel or derived region-wide competitive markets, the regional demand model is not needed. Here, observed prices and intervening costs, if any, are sufficient. However, prices derived for on-forest products from off-forest markets may vary from place to place in the region, even when the derived competitive market is uniform region-wide.

18. Changes in recreation supply that result in the opening or closing of recreation sites in the presence of excess demand are likely to be nonmarginal, as are capacity changes at congested sites. The nonmarginal nature of such changes in recreation supply derives from the fact that the price of the associated off-forest product, the recreation trip, varies throughout the region (i.e., the price is different at different locations).

19. Given certain assumptions, the on-forest demand function can be derived from the off-forest regional demand function. The on-forest demand curve may be more site-specific than the off-forest demand curve because of variation among locations in extraction and shipment costs and in site characteristics that affect product quality.

20. Depending on the kinds of supply changes contemplated, there may be significant components of net WTP relevant to RPA that are not expressed through normal demand for on-forest products. Option, existence, and bequest value, for example, may be important sometimes. Where it is important, such value should be measured. However, these components of value are not likely to be important for most changes in forest products. They are likely to become significant for actions that alter the populations of threatened and endangered species or which require irreversible major investments of natural resources, such as the addition or elimination of unique wilderness areas or some old growth stands of timber.

21. Past investment decisions may be assumed to have been somewhat inefficient because of incomplete information, imperfect control, and changing conditions or different objectives. Therefore, there should be potential within each region for improved efficiency through reallocation of investments. In any region, there may be many investment and disinvestment opportunities that will alter the supply of forest products. Some of these opportunities are likely to be more productive than others.

22. Given perfect information and control of the future, investments would be made first in the most productive opportunities. Under this ideal condition the notion of a single regional RPA value for each forest product would be nonsense. Instead, a demand schedule for capital would be used to identify each investment opportunity and expose its relative productivity. However, this ideal approach is not realistic because of the expense.

23. If intraregional investment decisions are assumed to be perfectly random (or uniform), the appropriate criterion for allocating investments among regions is the regional average unit value, (with the unit defined at the level of the investment decision, e.g., whole recreation sites or units of capacity at existing sites), and with each investment unit valued at the margin.

24. A realistic assumption is that intraregional investment decisions will be imperfect but will improve somewhat the productivity of forest resources. Under this assumption, a regional average RPA value for each forest product is too conservative. While development of a complete demand schedule of investment and disinvestment opportunities is likely to be prohibitively expensive, it may be reasonable to use a sample of observations to estimate a distribution of net WTP values for each region. Such an estimated distribution contains more information than a regional average value. The sample distribution could be used to estimate criterion values for investment and disinvestment in each region.

25. The economic efficiency objective requires inclusion of significant external costs and benefits. This can be done by incorporating them as "social costs" and "social WTP" in the supply and demand functions used to estimate marginal prices and nonmarginal values, or by adding them to the costs and benefits of management actions.

GR Guidelines and Conclusions

The following guidelines and conclusions are based on the assumption that display of the GR component of the NED value is needed for equity evaluation or assessment of impact on the government budget. The GR component is the price actually paid to the government for the forest

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product in question. Subtracting the supply cost from this demand price gives net government revenue. It is assumed here that tax revenue is a long-run matter and is not assignable to any given forest product.

1. GR is the demand-side contribution to producers' surplus retained by the government from production of a given forest product. The government's producer surplus is calculated in the same way that producers' surplus is measured for any firm. For joint costs, it may not be possible to separate net GR by forest products. Rather, it may be necessary to calculate net GR for separable management programs. However, GR should generally be separable by forest product.

2. GR is dependent on the pricing policy in effect. Pricing policy is a matter of government choice and may or may not be considered as fixed.

3. If pricing policy is considered fixed and the change to which value is to be assigned is marginal, the GR component of RPA value is the actual price (fee) paid to the government for the given forest product. If the price is zero, GR is zero. Actual fees may or may not be efficient.

4. If existing prices are inefficient and if GR is used as a sole criterion for allocation of public resources, the resulting resource allocation will be inefficient. Possible consequences include behavior of the government as a profit maximizing monopolist, and failure to provide efficient quantities of public goods and services such as wilderness, environmental quality control, etc.

5. If pricing policy is considered variable, the pricing policy to be used must be specified before the GR component can be estimated.

6. Nonmarginal changes that cause price change are valued in terms of the difference in GR before vs. after the change.

CS Account Conclusions

The following comments are based on the assumption that display of the CS account is needed for assessment of impact on final demand.

1. Consumers' surplus represents real national welfare if the justification for value is individual preferences (consumer sovereignty).

2. Consumers' surplus is the NED value less its GR and NPR components.

3. For marginal change with price rationing, the CS-related RPA value is always zero.

4. With nonprice rationing, the CS value may not be zero, even when change is marginal. Therefore, pricing and rationing policy should be evaluated before concluding that CS is zero in the marginal case.

5. For nonmarginal change there is no general value that applies to all situations. The appropriate value is the difference in CS with and without the change. It may be possible to calculate an average unit CS price for a given change that applies to that situation, but it is not likely to be applicable to all other situations.

6. Consumers' surplus is not just an issue with nonmarket goods. Nonmarginal changes in private goods also cause changes in consumers' surplus.

NPR Account Conclusions

The following comments are based on the assumption that measurement of Net Revenue to Private Firms (NPR) is needed to display impact on commerce and industry in the private sector.

1. NPR is the amount by which the real profit of private firms has been increased as a result of the government action in question. As with GR and CS, it is a component of net contribution to NED. It is the demand-side producers' surplus resulting from the action.

2. Demand-side producers' surplus is the NED value less its GR and CS components.

3. With distorted prices NPR may not be zero, even when the government action has only marginal consequences. Therefore, prices should be scrutinized for distortion before concluding that NPR is zero in the marginal case.

4. For nonmarginal change there is no general NPR value that applies to all situations. The appropriate NPR value is the difference in demand-side producers' surplus with and without the change. It may be possible to calculate an average NPR price for a given change that applies to that situation; but it is not likely to be generalizable to other situations.

Conclusions Regarding Equity

The following conclusions are based on the assumption that the equity of resource allocation is an important consideration.

1. Equity is a question about fairness of the effect of a given action on the distribution of income among various accounts.

2. Equity cannot be decided by technical means. It is a political question concerned with the resolution of conflicts among the preferences of separate individuals or groups. To specify a formula by which to judge equity is to preempt political rights by assigning importance weights to different people.

3. If a criterion for judging equity in a given situation has been specified by sovereign authority, either in a command economy by authority of power or by legislation and social contract in a democracy, measurement of the achievement of equity becomes a technical responsibility. However, the definition is likely to be volatile and subject to continual revision in a democracy in which government derives its powers by consent of the governed.

4. Equity can be judged in terms of hypothetical philosophical maxims; but the outcome bears no practical validity unless either the maxim or the judge has sovereign power over all concerned.

5. Without a valid rule for judging equity, the appropriate technical response is impact assessment by which the consequences of a proposed action are exposed effectively to all concerned. Economic impact is an important component of impact assessment. In economic impact analysis the economic consequences of a proposed action are exposed, so that all affected people and institutions can make informed choices regarding their political, litigational, market, or radical response to the proposal.

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6. In its pure form, economic impact analysis exposes the net change in the economic well being of each affected interest. It is thus disaggregate measurement of gains and losses, whereas benefit-cost analysis sums these gains and losses to measure aggregate change. The economic impacts may be described in terms of individuals, social and ethnic groups, geographic regions, sectors of the economy, or future generations.

7. Disaggregation of the NED RPA value into GR, CS, and NPR components is one way to assess economic impact. It is exposure of the changes in wealth of the government, final demand, and private industry sectors of the economy. Just as disaggregation of NED into GR, CS and NPR results in three different components as seen from three different points of view, other points of view will lead to still other components.

8. This "pure" form of economic impact analysis is seldom if ever done. Rather, surrogates, such as income, employment, expenditures, etc., are used through tools such as input-output analysis, or public participation and review are used as substitutes for or complements to economic impact assessment.

Summary

An RPA value is the demand-side value for a specific change in the quantity of a forest product at the on-forest point of production. Thus, it is the residual bid, or "willingness to pay," to the land management agency for the management-induced change. The philosophical basis for this notion of value is "consumer sovereignty." The practical basis for this value is free market exchange, whereby something is worth the amount of money for which it is or could be exchanged. The point of valuation is on the forest, or at the point of separation from the forest. The impetus for this value is a change in the output of an on-forest product.

An RPA value is part of an evaluation process to rank policy alternatives characterized by mixes of management activities and associated outputs. The planning model is one of trial and error, in which several alternatives are first designed, then evaluated and ranked. Monetary value in this framework has meaning only in terms of change. The change is the difference between the output level with a base or null alternative and the output with some other alternative. The most practical null alternative for RPA planning is a continuation of current management direction. RPA values are then estimated for the on-forest products whose levels of output differ among the alternatives.

If economic efficiency at the national level is an objective of the evaluation of alternatives, values that measure the demand-side contribution to national economic development (NED) are needed. These values measure the full willingness to pay for the management-induced change. This objective reflects the perspective that the identification of the particular people or groups who receive the benefits of the changes or pay the costs is not at issue. The values measured in terms of contribution to the NED account can be apportioned from the perspective of particular sectors of the economy.

One possible apportionment is among the government, private business, and consumer sectors. If a balanced federal budget is an objective, the contribution to government revenue (GR) is an important consideration. If return to private commerce and industry is an objective, the contribution to net private revenue (NPR) is important. If individual purchasing power (quality of life) is of concern, consumer surplus (CS) is important. Because value from the NED perspective = GR + NPR + CS, disaggregation of NED gains or losses in these three sectors of the economy is one approach to addressing equity considerations.

GR is the demand-side contribution to producers' surplus, or the portion of total willingness to pay retained by the government from production of on-forest products. Subtracting government costs yields the government's producer surplus, which is calculated in the same way as producers' surplus for any firm. NPR + CS is the portion of total willingness to pay for the on-forest product retained by the purchasers, and will be important if a change is nonmarginal, or even for marginal change if consumption is rationed by means other than prices. NPR is the portion that accrues to private firms. CS is consumers' surplus accruing to consumer final demand.

The products to be valued must be specified, and appropriate units of measure must be chosen for each. There is tradeoff here between accuracy and complexity. The products and their respective units should be defined by forest product specialists who understand the processes of production and consumption, the application intended for the values, and the valuation process.

An RPA value for a given forest product can be expected to vary by production location if there are differences in access to markets that result in differences in shipment costs, or if there are differences in local site attributes that cause production and extraction costs to vary from place to place. It would be unusual for a single value to be valid region-wide. Also, there may be opportunities for new investment that are of greater value than some existing operations, such that the RPA value of the most efficient investments is different from the RPA value of the most efficient disinvestments.

To evaluate and rank all the investment and disinvestment opportunities facing a management unit (e.g., a region) is impractical. A more reasonable approach is to evaluate a sample of opportunities and to estimate a distribution of value from that sample. Then, if it is assumed that a management unit will tend to make efficient decisions, the appropriate RPA investment value should be above the average of that distribution, and the appropriate disinvestment value should be below the average. However, if little improvement over random or uniform selection of projects within a management unit is expected, the values should be near the average.

The prices assumed to be in effect for on-forest products will influence returns calculated in the NED, GR, NPR, and CS accounts, and thus the RPA values. It is necessary to decide which prices to use as a basis for estimating RPA values. The most appropriate prices are those expected to be in effect during the planning horizon of the RPA analysis.

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There are two basic approaches to estimation of an RPA value: (1) observation of demand in real markets; and (2) observation of demand in hypothetical markets. In either case, marginal and nonmarginal change must be clearly distinguished. A marginal change does not significantly change prices; a nonmarginal change does. For marginal change in the quantity of an on-forest product, the appropriate NED value is the price that would be defined by perfectly competitive equilibrium between on-forest supply and demand, where marginal willingness to pay equals marginal cost. Here only one point in the demand curve is relevant. For nonmarginal change, the value of a supply change is again net willingness to pay for the change; but this must be calculated by integration of the on-forest demand function over the range of the price change. The appropriate NED value is then the per-unit willingness to pay (the total divided by the quantity change).

Because of locational uniqueness or pricing policy, on-forest products are often not sold in competitive markets, and direct estimation of their demand functions is difficult. However, it is often possible to estimate region-wide prices or demand models for derived, off-forest products, such as lumber, red meat, water at point of use, or recreation trips. A properly specified generalized regional off-forest demand model may be capable of describing the demand behavior of any homogeneous subunit of a region, given the parameters of the subunit. Then, subtracting intervening costs from the willingness to pay for the off-forest product yields a valid RPA value for the on-forest product.

Published RPA values should be accompanied by an explanation of the theoretical framework and associated accounting stance for which they were derived. They also should be accompanied by information and procedures for estimating on-forest product values that consider specific decisions and conditions to which published "generic" values are not applicable. Such procedures most likely would include off-forest demand models that could be used at the forest or project level to estimate site-specific values.

Selected References

Adams, Darius M.; Richard W. Haynes. The 1980 softwood timber assessment market model. For. Sci. Mono. 22; 1980. 64 p.

Bromley, Daniel W. Land and water problems: an institutional perspective. Amer. J. Agric. Econ. 64: 834–844; 1982.

Brown, Thomas C. Monetary valuation of timber, forage, and water yields from public forest lands. Gen. Tech. Rep. RM–95. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1982. 26 p.

Brown, Thomas C. The concept of value in resource allocation. Land Econ. 60(3): 231–246; 1984.

Dwyer, J. F.; Kelly, J. R.; Bowes, M. D. Improved procedures for valuation of the contribution of recreation to national economic development. Res. Rep. No. 128. Urbana, IL. Water Resources Center, University of Illinois; 1977. 218 p.

Forest and Rangeland Renewable Resources Planning Act of 1974, Pub. L. No. 93–378, 88 Stat. 476 (Codified at 16 U.S.C. 581h, 1601–1610 (1976), as amended by 1976, Pub. L. No. 94–588, 90 Stat. 2949.)

Freeman, A. M. III. The benefits of environmental improvement. Baltimore, MD: The Johns Hopkins University Press; 1979. 272 p.

Gibbons, Diana C. The economic value of water. Baltimore, MD: Resources for the Future, The Johns Hopkins University Press; 1984. 101 p.

Henderson, James E.; Quandt, Richard E. Microeconomic theory: a mathematical approach. 3rd ed. New York: McGraw-Hill; 1980. 420 p.

Just, Richard E.; Hueth, Darrell L.; Schmitz, Andrew. Applied welfare economics and public policy. Englewood Cliffs, NJ: Prentice-Hall, Inc.; 1982. [unknown] p.

McKean, Roland N. Efficiency in government through systems analysis. New York: Wiley; 1958. 336 p.

Mishan, E. J. Economic efficiency and social welfare. Boston, MA: George Allen and Unwin; 1981. 280 p.

Mishan, E. J. Benefit cost analysis. New York: Praeger; 1976. 454 p.

Mishan, E. J. Introduction to normative economics. New York: Oxford University Press; 1981. 548 p.

National Forest Management Act of 1976, Pub. L. No. 94–588, 90 Stat. 2949 (Codified at 16 U.S.C. 581h, 1601–1614. 1976).

Pearce, David W. The valuation of social cost. Boston, MA: George Allen and Unwin.; 1978. 197 p.

Peterson, George L.; Brown, Thomas C. The economic benefits of recreation: common disagreements and informed replies. In: Proceedings, Southeastern Recreation Researchers' Conference; 1985 February 28–March 1; Myrtle Beach, SC. Statesboro, GA: Department of Recreation and Leisure Services, Georgia Southern University; 1986: 17–33.

Peterson, George L.; Randall, Alan. Valuation of wildland resource benefits. Boulder, CO: Westview Press; 1984. 272 p.

Randall, Alan. Resource economics. Columbus, OH: Grid Publishing; 1981. 415 p.

Rosenthal, Donald H.; Brown, Thomas C. Comparability of market prices and consumer surplus for resource allocation decisions. J. For. 83(2):105–109; 1985.

Samuelson, Paul A. Economics. 10th ed. New York: McGraw-Hill; 1976. 917 p.

Sassone, Peter G.; Schaffer, William A. Cost-benefit analysis: a handbook. New York: Academic Press; 1978. 182 p.

Sinden, J. A.; Worrell, Albert C. Unpriced values: decisions without market prices. New York: John Wiley; 1979. 511 p.

U.S. Forest Service. National forest system land and resource management planning. Federal Register, September 30, 1982.

U.S. Water Resources Council. Economic and environmental principles and guidelines for water and related land resources implementation studies. Washington, DC: U.S. Government Printing Office; 1983. [unknown] p.

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Peterson, George L., Thomas C. Brown, and Donald H. Rosenthal. An improved framework for estimating RPA values. Gen. Tech. Rep. RM–138. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1987. 13 p.

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Rocky Mountains

Southwest

Great Plains

U.S. Department of Agriculture
Forest Service

Rocky Mountain Forest and Range Experiment Station

The Rocky Mountain Station is one of eight regional experiment stations, plus the Forest Products Laboratory and the Washington Office Staff, that make up the Forest Service research organization.

RESEARCH FOCUS

Research programs at the Rocky Mountain Station are coordinated with area universities and with other institutions. Many studies are conducted on a cooperative basis to accelerate solutions to problems involving range, water, wildlife and fish habitat, human and community development, timber, recreation, protection, and multiresource evaluation.

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Flagstaff, Arizona
Fort Collins, Colorado*
Laramie, Wyoming
Lincoln, Nebraska
Rapid City, South Dakota
Tempe, Arizona

*Station Headquarters: 240 W. Prospect St., Fort Collins, CO 80526

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